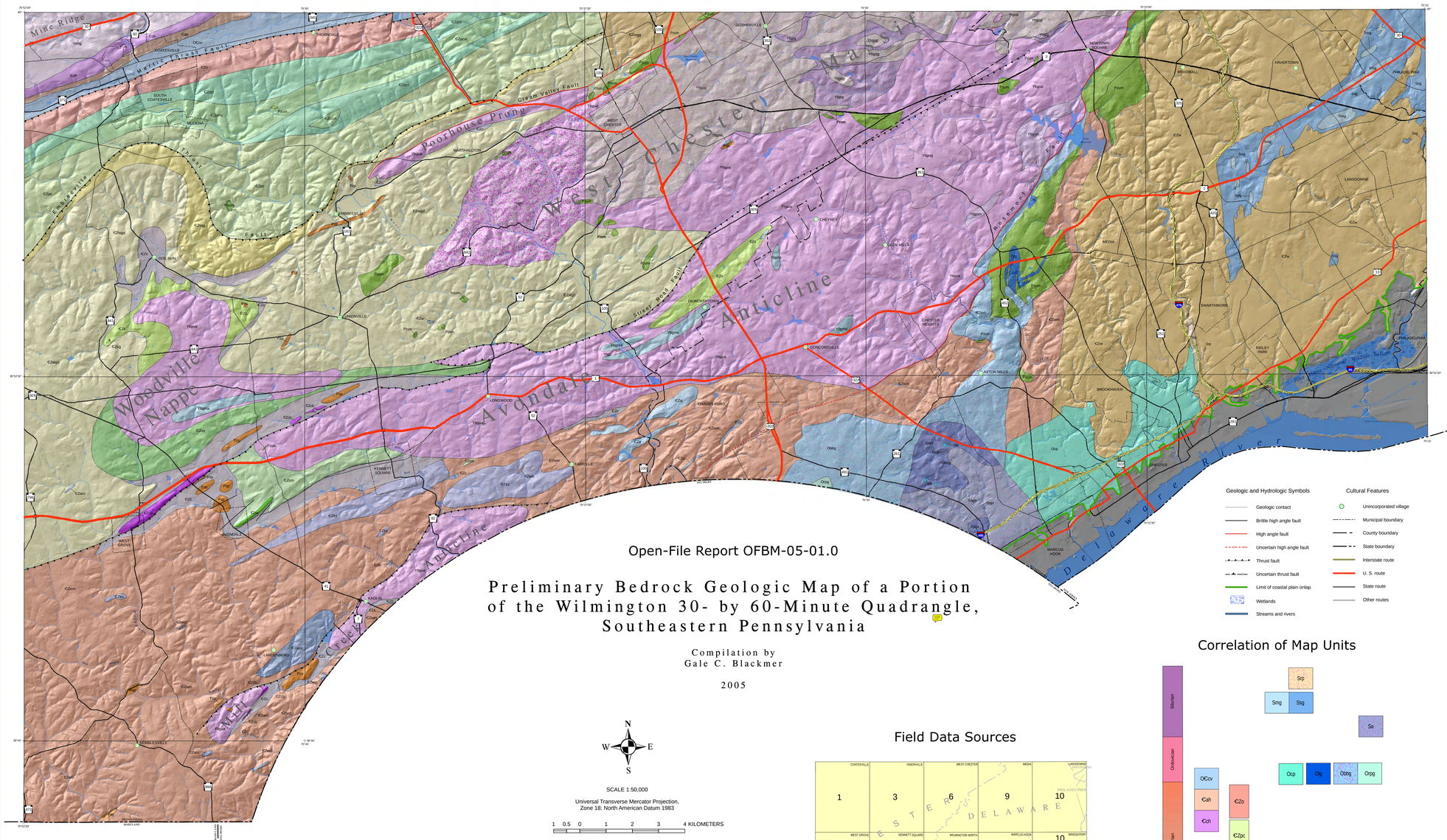
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
Michael DiBerardinis, Secretary

COMMONWEALTH OF PENNSYLVANIA
Edward G. Rendell, Governor

BUREAU OF TOPOGRAPHIC AND GEOLOGIC SURVEY
Jay B. Parrish, Director



Open-File Report OFBM-05-01.0

Preliminary Bedrock Geologic Map of a Portion of the Wilmington 30- by 60-Minute Quadrangle, Southeastern Pennsylvania

Compilation by
Gale C. Blackmer

2005

N
W E
S

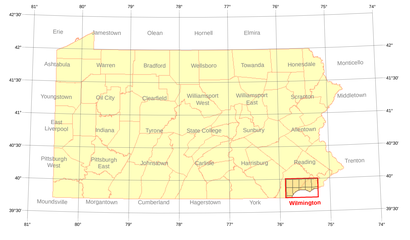
SCALE 1:50,000

Universal Transverse Mercator Projection,
Zone 18; North American Datum 1983

1 0.5 0 1 2 3 4 KILOMETERS

1 0.5 0 1 2 3 4 MILES

Location of Map Area and 30- by 60-Minute Quadrangles



Map Credits

Geology

Locations of faults and geologic contacts of bedrock units are based on field mapping by persons listed under Field Data Sources.

Base Map

Municipal, county, and state boundary lines are clipped and modified from Pennsylvania Department of Transportation layers, http://www.pasda.psu.edu/access/padot.shtml, 2004, 1:24,000-scale accuracy.

Pennsylvania 7.5-minute quadrangle boundaries are from the U. S. Geological Survey, Quadrangle boundaries in Pennsylvania, http://gis2.pasda.psu.edu/Pasda/UCI_Metadata/pasdaquads24k.htm#3, 2002, 1:24,000 scale accuracy.

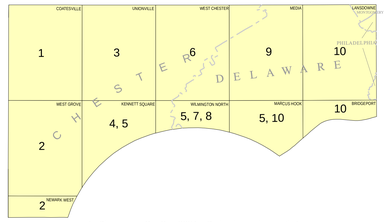
Water bodies are from the U. S. Geological Survey, National Hydrography Dataset (NHD), http://nhd.usgs.gov/, 1:24,000 scale accuracy.

Shaded relief layer is from the seamless raster format of the USGS National Elevation Dataset (NED) 1/3 arc second (10m) data, http://ned.usgs.gov/.

Other

Map layout and design by Gale C. Blackmer and Stuart O. Reese, Pennsylvania Geological Survey, 2005. Cartography by Stuart O. Reese, 2005.

Field Data Sources



1. Blackmer, G. C., 2004, Bedrock geology of the Coatesville quadrangle, Chester County, Pennsylvania: Pennsylvania Geological Survey, 4th ser., Atlas 189b, CD-ROM.
2. Blackmer, G. C., field mapping 1999-2002 (STATEMAP).
3. Wiswall, C. G., field mapping 2002-2005 (STATEMAP).
4. Blackmer, G. C., 2004, Bedrock geologic map of the Pennsylvania portion of the Kennett Square 7.5-minute quadrangle, Chester County, Pennsylvania: Pennsylvania Geological Survey, Open File Report OFBM 04–01.0, scale 1:24,000 (STATEMAP).
5. Schenck, W. S., Plank, M. O., and Srogi, L., 2000, Bedrock geologic map of the Piedmont of Delaware and adjacent Pennsylvania: Delaware Geological Survey Map Series No. 10, scale 1:36,000.
6. Bosbyshell, H., field mapping 2003-2004 (STATEMAP).
7. Williams, S., field mapping 2002.
8. Blackmer, G. C., and Bosbyshell, H., field checks 2005.
9. Bosbyshell, H., field mapping 2002-2003 (STATEMAP).
10. Bosbyshell, H., field mapping 2004-2005 (STATEMAP).

Geologic and Hydrologic Symbols

- Geologic contact
- Brittle high angle fault
- High angle fault
- Uncertain high angle fault
- Thrust fault
- Uncertain thrust fault
- Limit of coastal plain onlap
- Wetlands
- Streams and rivers

Cultural Features

- Unincorporated village
- Municipal boundary
- County boundary
- State boundary
- Interstate route
- U. S. route
- State route
- Other routes

Correlation of Map Units

Combined Units in Correlation Chart

- Czwg — Glenarm Wissahickon formation
- Ybg — Baltimore Gneiss
- Sa — Arden Plutonic Supersuite

BEDROCK UNITS

Ultramafic rock (Pzum)
Primarily serpentinite, ranging in color from dark green to yellow-green. Steatite, chlorite-talc schist, anthophyllite schist, pyroxenite, and norite are also present. Relationships between the ultramafic and surrounding rocks, and between the ultramafic bodies themselves, are unclear. Age is also uncertain.

Pegmatite (Pzp)
Granitic pegmatite bodies of various sizes and ages. Primary constituents are quartz and potassium feldspar, with lesser muscovite, biotite and, locally, garnet and tourmaline.

Ridley Park Granite (Srp)
Medium to coarse grained, moderately to strongly foliated granitic gneiss composed of microcline, quartz, plagioclase, biotite, and muscovite. Accessory minerals include garnet, apatite, titanite, and zircon.

Mafic gneiss (Smg)
Fine to coarse grained, foliated to massive amphibolite and metagabbro, composed of hornblende, plagioclase, biotite, quartz and pyroxene, with accessory epidote, apatite, and titanite. Pyroxene occurs as small cores of relict grains now almost entirely replaced by hornblende.

Springfield Granodiorite (Ssg)
Medium to coarse grained, moderately to strongly foliated plagioclase-quartz-microcline-biotite-epidote gneiss having minor hornblende. Portions exhibit porphyritic texture characterized by 2-4 cm plagioclase and microcline crystals.

Wilmington Complex

Arden Plutonic Supersuite

Ardentown Granitic Suite (Sags)
Silicic rocks containing plagioclase, orthopyroxene, clinopyroxene, potassium feldspar, quartz, and biotite. Includes quartz norite, quartz monzonorite, opdalite, and charnockite. Phenocrysts of potassium feldspar and plagioclase are common.

Perkins Run Gabbronorite Suite (Sbgn)
Mafic and minor intermediate rocks, typically having 50-60% labradorite, subequal amounts of orthopyroxene and clinopyroxene, hornblende, and less er olivine and biotite. Contemporaneous wit h the Ardentown Granitic Suite.

Biotite tonalite (Sbt)
Equigranular biotite tonalite is found as rounded boulders.

Rockford Park Gneiss (Orpg)
Interlayered mafic and felsic gneiss. Felsic layers consist of quartz and plagioclase, minor orthopyroxene and, locally, clinopyroxene. Mafic layers are fine grained, consisting of plagioclase, orthopyroxene, clinopyroxene, hornblende, and minor quartz and biotite. The nature of the contacts with the Brandywine Blue Gneiss is obscured by deformation and metamorphism.

Brandywine Blue Gneiss (Obbg)
In Pennsylvania, intermediate to felsic gneiss and interlayered intermediate, felsic, and mafic gneiss. Mineral assemblages indicate amphibolite facies metamorphism, although the local presence of orthopyroxene indicates that some areas reached granulite facies.

Lima Granite (Olg)
Variably foliated plagioclase-microcline-quartz-hornblende-biotite gneiss and granofels. Intrusive into the surrounding ultramafic rock.

Chester Park gneiss (Ocp)
Medium to coarse grained plagioclase-quartz-biotite gneiss and schist. Local aluminous domains contain muscovite, garnet, kyanite, sillimanite, or cordierite. Irregularly shaped, elongate biotite-rich enclaves range in size from a few centimeters to several meters long. Generally massive, but layering, defined mainly by biotite abundance, is present locally.

Conestoga Formation through Vintage Formation, undivided (OCcv)
Carbonate rocks of various composition. Elbrook, Ledger, Kinzers, and Vintage Formations not exposed in map area. Conestoga Formation is massive to thinly layered, blue-gray crystalline limestone having schistose partings, abundant calcite veins, and small calcite pods.

Antietam and Harpers Formations, undivided (Cah)
Thinly layered quartzose schists consisting of a ternating laminae of quartz-feldspar and mica. Randomly oriented tourmaline on micaceous foliation planes. Thin layers of granitic pegmatite are common.

Chickies Formation (Cch)
Light-gray to white, massive or thin-bedded, vitreous quartzite, commonly having spaced mica partings. Thin quartzose schists are locally interlayered with the quartzite. Tourmaline is a locally common accessory mineral.

Octoraro Formation (Czo)
In the map area, quartz-muscovite-chlorite-plagioclase schist with thin interlayers of black phyllonite. Chloritoid and pyrite, or pseudomorphs of limonite after pyrite, are locally abundant. Millimeter-scale plagioclase porphyroclasts are common. Well-developed schistosity lends a moderate fissility to the rocks.

Peters Creek Schist (Czpc)
Pinstriped quartz-plagioclase-muscovite-biotite-chlorite-epidote ± garnet schist having abundant magnetite and discontinuous quartz veins and pods. Quartz-feldspar layers alternating with submillimeter- to millimeter-scale mica layers give the rock its distinctive striped appearance. Centimeter- to outcrop-scale layers of gray or tan metasandstone are common.

Peters Creek Schist – variably tectonized (Czpct)
Facies of Peters Creek Schist exhibiting myl onitic or phyllonitic characteristics but still recognizable as Peters Creek Schist. Centimeter- to meter-scale phyllonite interlayers are common. Meter-scale metasandstones are abundant. Grades into Peters Creek tectonite.

Peters Creek tectonite (Czpct)
Southern branch is dark-greenish-gray quartzose phyllonite. Northern branch is black to silvery black phyllonite containing little quartz, although quartz veins are common. The bands merge off the map to the northeast.

Amphibolite (Cza)
Hornblende-plagioclase-quartz amphibolite, with or without clinopyroxene. Occurs as layers or pods within the Mt. Cuba Wissahickon formation, Glenarm Wissahickon formation, and Setters Formation. Where contacts are exposed, amphibolite is concordant with layering and foliation in the surrounding rocks. Those occurrences that have been analyzed fall into two groups based on geochemistry.

Kennett Square Amphibolite (Czks)
Geochemically similar to ocean-floor basalt. Diopside, epidote and quartz-epidote symplectite are common.

White Clay Creek Amphibolite (Czwcg)
Geochemically similar to continental initial rift basalt .

Wissahickon Formation (Czw)
Pelitic schist and gneiss interlayered at centimeter scale with psammitic granofels and quartzite. Appearance and mineralogy vary considerably with metamorphic grade, which increases southward from lower to upper amphibolite facies . Interlayers of bonini tic amphibolite are common.

Mt. Cuba Wissahickon formation (Czam)
Pelitic gneiss and pelitic schist with subordinate amphibolite and pegmatite. Predominant lithology is quartz-plagioclase-biotite-muscovite gneiss, with or without minor sillimanite and small garnets. Mica content in the gneiss varies, but the sum of quartz and feldspar is always greater than mica. Pegmatite bodies of various sizes and relative ages are ubiquitous. Some appear to be the products of in-situ partial melting. Patches of pelitic schist within the gneiss with abundant biotite, sillimanite, and large garnets may represent restite. Staurolite is present in the schist near the contact with the Cockeysville Marble around the west end of the Avondale Anticline.

Glenarm Wissahickon formation

Doe Run schist (Czwgd)
Garnet-staurolite-kyanite pelitic schist with abundant biotite and muscovite. Sparse sillimanite also present in the south and east. Amphibolite interlayers are rare.

Laurels schist (Czwgl)
Quartz-plagioclase-muscovite-chlorite-garnet schist with minor biotite. Characterized by well-defined compositional layering. Interpreted as highly strained and retrograded pelitic schist within the Embreeville thrust zone.

Greystone schist (Czwggy)
Quartz-plagioclase-muscovite-chlorite metasandstone to psammitic schist, locally having biotite and garnet. Distinctly finer-grained and richer in quartz and feldspar than the Doe Run schist.

Glenarm Group

Cockeysville Marble (Czc)
In Pennsylvania, layered calcite and dolomite marble with minor phlogopit e, quartz, microcline, and diopside. Six-inch to six-foot thick layers of sulfidic quartzose schist consisting of quartz, plagioclase, microcline, muscovite, and biotite, with local sillimanite and garnet, are common.

Baker gneiss (Czcb)
Microcline-muscovite-quartz-biotite gneiss similar to Setters microcline gneiss, interlayered with muscovite-microcline-quartz-biotite-sillimanite-sericite-garnet schist.

Setters Formation (Czs)
Undifferentiated microcline gneiss and quartzite.

Setters microcline gneiss (Czsm)
Gneiss containing 50% or more microcline, with quartz, biotite, and muscovite. Locally schistose due to abundant post-kinematic muscovite.

Setters quartzite (Czsq)
80-90% quartz with microcline, muscovite, and biotite, and rare local interlayers of microcline gneiss.

Avondale schist (Czsa)
Biotite-muscovite-quartz pelitic schist with abundant pegmatite pods and large crystals of tourmaline and garnet.

Green Lawn marble (Czsg)
White, coarse-grained impure calcite marble with minor quartz and phlogopite.

Baltimore Gneiss

Undifferentiated Baltimore Gneiss (Ybg)
Heterogeneous amphibolite and granulite facies, medium- to coarse-grained, mafic to felsic gneiss. Granulite facies gneiss contains pyroxene; amphibolite facies gneiss contains hornblende.

Undifferentiated amphibolite facies gneiss (Ybgua)
Heterogeneous felsic, intermediate, and mafic amphibolite facies gneiss. Predominant lithology is intermediate plagioclase-hornblende-quartz-biotite gneiss with local orthopyroxene, clinopyroxene, potassium feldspar, and garnet. Swirling migmatite leucosome and biotite-rich restite layers are common. Felsic gneiss consists of quartz, plagioclase, microcline, and biotite with local muscovite and garnet. Mafic gneiss is hornblende-plagioclase-quartz amphibolite with garnet and subordinate biotite.

Mafic amphibolite facies gneiss (Ybgma)
Hornblende-plagioclase-quartz amphibolite with garnet and subordinate biotite.

Franklin Marble (Ybgf)
White, coarsely crystalline, impure marble with abundant quartz and phlogopite.

Sycamore Mills gneiss (Ybgsm)
Amphibolite facies pelitic gneiss consisting of garnet, biotite, sillimanite, quartz, plagioclase, and orthoclase, with local kyanite and muscovite.

Undifferentiated granulite facies gneiss (Ybgug)
Heterogeneous felsic, intermediate, and mafic granulite facies gneiss. Predominant lithology is felsic to intermediate plagioclase-quartz-orthopyroxene-clinopyroxene-garnet-hornblende-biotite gneiss. Mafic gneiss has subophitic texture and consists of olivine, orthopyroxene, clinopyroxene, and plagioclase. All compositions have coronas of garnet, amphibole, or clinopyroxene between plagioclase and orthopyroxene grains.

Quartzofeldspathic granulite facies gneiss (Ybgqg)
Quartz-plagioclase-potassium feldspar-orthopyroxene-clinopyroxene-garnet-biotite gneiss.

Intermediate and mafic granulite facies gneiss (Ybgig)
Orthopyroxene-clinopyroxene-plagioclase-garnet gneiss, locally having hornblende and biotite.

Mafic and felsic gneiss (Ymfg)
Mafic, hornblende-bearing gneiss with centimeter-scale, wispy to throughgoing felsic layers. Exposures are sparse in the map area.